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Article

Tracking the Green Transition in the European Union Within the Framework of EU Cohesion Policy: Current Results and Future Paths

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Abstract: Green transition is one of the priority areas in the European Union (EU), and thus also the focus of EU cohesion policy implementation during the 2021–2027 programming period, through “green growth”. To establish adequate guidelines and achieve better outcomes, it is necessary to observe and evaluate current results connected with these aspects. In terms of the complexity of the green transition domains, measuring green transition is still developing. The aim of this paper is to give an overview of the approaches that can be used in tracking the green transition as a result of EU cohesion policy implementation and to analyse achievements associated with the green transition. This will be done using desk research, previous studies, documents, evaluation reports and secondary data on the financing under the European Structural and Investment Funds (ESIFs) in EU member states, with a special emphasis on themes such as the low-carbon economy, climate change adaptation and risk prevention, environment protection and resource efficiency, and network infrastructure in transport and energy. The paper discusses these results in the context of the current challenges faced by the EU in becoming a leader in the green transition and contributes to the evaluation of the EU cohesion policy.

Keywords: EU cohesion policy; ESIFs; green transition; tracking



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1. Introduction

Various adverse effects and crises resulting from environmental degradation and pressures, as confirmed by numerous studies and scientific research, necessitate the creation of new approaches to managing development (Ghorbal et al., 2021; Denzin & Cabrera, 2017). OECD (2012) warns about the necessity to include environmental considerations in the process of defining every aspect of national policies. This is a demanding task which requires significant resources as well as innovative approaches to engage all relevant stakeholders. It goes beyond national borders, as demonstrated by the European Union (EU) framework, where green growth is a central focus of the EU strategic agenda, under the priority “A prosperous and competitive Europe” (European Council, 2024). Because of this, the EU has placed the financing of different aspects of the green economy at the top of its development priorities of the current 2021–2027 programming period. Today, green policies cover a range of areas such as the environment, air quality, clean energy, sustainable industry, healthy soil, biodiversity, etc. These policies encompass numerous guidelines, regulations and practices, aimed at reducing negative environmental impacts and promoting sustainable development. Green policies are integrated into many EU and national policies and can be analysed from various perspectives.

The European Green Deal represents a comprehensive growth strategy introduced in 2019 with the aim of achieving climate neutrality by 2050 (European Council, Council of the European Union, 2024). It includes numerous packages and policy initiatives designed to boost the green transition and achieve its objectives. The transition towards net-zero greenhouse gas emissions by 2050 is a very ambitious and complex plan that requires substantial financial resources to implement reforms. European Structural and Investment Funds (ESIFs) represent one of the sources for EU grants that many beneficiaries can use to reach the goals, including those in the “green” domain. This is implemented under the principles of the EU cohesion policy. To create adequate guidelines, address issues, correct imbalances and finally achieve the targets of the transition in line with the needs, it is necessary to monitor results and continuously evaluate implementation. Given the complexity of the green transition, this is not an easy task. Approaches to tracking the green transition are still developing, challenged by the numerous domains encompassed in green policies and constraints in measuring progress.

The aim of this paper is to provide an overview of approaches to tracking the green transition within the implementation of EU cohesion policy and to analyse key achievements. The contribution to the European Green Deal is recognized as an important aspect of the EU cohesion policy evaluation, and this paper also tries to contribute to this area. The novelty of the paper can be seen in collecting and comparing different approaches (indicators/methodologies) applied to measure the achievements of EU cohesion policy in the context of the green transition. It highlights a broad range of indicators that can be used for evaluation, despite the difficulty of comparing results and achievements across different areas connected with the green transition. The analysis adds to the literature that has been less focused on measuring the contribution of EU funds to the green transition, even though the role of EU cohesion policy in facilitating the green transition is widely acknowledged. The paper also gives a critical observation on the challenges of the green transition in EU member states and comments on role of the EU cohesion policy in this process.

The next section presents the literature review, explaining the importance and the framework of EU green policies and their connection with the EU cohesion policy. It also includes a review of previous studies on monitoring the contribution of the EU funds towards sustainable, green growth and development, as well as different approaches to measuring green transition. This is followed by an analysis of secondary data on EU funds’ investments and progress indicators related to themes such as the low-carbon economy, climate change adaptation and risk prevention, environment protection and resource efficiency, and network infrastructure in transport and energy within EU member states. These themes represent the thematic priorities of the ESIFs’ investments, as outlined in European Commission (2024b). The final section offers a conclusion and gives implications for future studies.

2. Literature Review

The EU is now a global leader in the development of green policies, starting in the 1970s with Environmental Action Programmes (EAP), followed by the Europe 2020 strategy, where one of the goals refers to climate/energy targets (reducing greenhouse gases by 20%; a 20% increase in the energy efficiency, and increasing the share of renewable energy sources to 20%) (European Commission, 2010). The European Green Deal is one of the six priorities of the European Commission for the 2019–2024 period. This plan represents the EU’s framework and ambition to become climate neutral by 2050. It ensures: no net emissions of greenhouse gases by 2050; economic growth decoupled from resource use and emissions, and no person and no place left behind (European Commission, 2024n). In other words, it represents the new growth strategy for an EU economy that is sustainable,

cleaner, more inclusive, safer and healthier. In 2024, the European Commission represents recommendations for the 2040 emissions reduction target, including policy conditions necessary to achieve the target (European Commission, 2024c).

The European Green Deal goals are beneficial in many aspects beyond climate and the environment. In the economic area, they represent opportunities for the creation of new jobs and the development of new technologies. EU member states are not homogeneous in defining the climate goals because there is significant development heterogeneity among them and the green policies do not have the same priority in every member state. As one country sets a higher national climate objective, it results in a higher cost for business. It can represent a burden for EU competitiveness. EU is lagging behind its main competitors in terms of productivity, growth dynamics and innovations. Draghi's report on EU competitiveness (European Commission, 2024a), stated that decarbonisation (climate targets) can be an opportunity for EU competitiveness if it would result in a coherent plan, but at the same time, if a coordination of policies is missing, the results of the green policy could go in the opposite direction. Vironen et al. (2019) present opportunities and challenges for the EU cohesion policy in facilitating the transition to a low-carbon economy. They note the importance of coordination of national and regional policies and supporting actions in the implementation of low-carbon projects to ensure their effectiveness, and also provide lessons for the 2021–2027 period. Useful guidelines for decision-makers on the national and regional level on how to operationalise the concept of sustainability transition under the European Green Deal with the help of the EU cohesion policy can be found in Kelemen (2020). Feld and Hassib (2024) discuss the goals and possible synergies of EU cohesion and climate policies. They highlight the potential conflicts and challenges in their alignment, which should also be considered in the implementation of these policies.

The EU goals are discussed in the framework of industrial policy, where the second pillar of Green Deal Industrial Plan is focused on speeding up the investments and financing the clean-tech production in Europe (European Commission, 2023). Changes in the industrial structure are necessary to achieve the green targets, but this also represents an important challenge in the process of transformation.

In the long run, there is no doubt investments in low-carbon technologies would positively influence economic growth (OECD, 2021; Erbach et al., 2022; Wani et al., 2024). In the short run, investments in green policies require huge financial amounts, while growth should be decoupled from the emissions and the resources, which can result in negative effects if the consumption and production decrease due to price increase. Because of these non-estimated implications, it is important to set up good economic governance (where the EU cohesion policy can be important part).

The green transition is supported by substantial financial means coming from the EU budget. This paper focuses on the ESIFs (i.e., EU cohesion policy), because ESIFs are recognized as important resources that contribute to European Green Deal goals, including the green transition. 30% of the European Regional Development Fund (ERDF) budget and 37% of the Cohesion Fund budget for the 2021–2027 period should be allocated to achieving climate targets (European Commission, 2021). Previous studies confirm the importance of the EU funds for green transition.

Leonard et al. (2021) indicate the need to internationalize the European Green Deal by leveraging the EU budget and the EU Recovery and Resilience Facility¹, and EU development policy. Similarly, Ciot (2022) highlighted that the success of the Green Deal implementation in Central and Eastern Europe will depend on the recovery and resilience funds. He noted that there are negative perspectives regarding its implementation in these countries. EU funds focus on contributing to recovery and resilience, while addressing

the need for greening growth and development, and for green transition. Differences in outcomes and asymmetric impacts can be observed and expected across EU member states.

Numerous previous studies also emphasize the need to integrate environmental aspects and goals within various policies. They highlight the importance of evaluating the effects and returns on investments in areas related to the green transition. [Scown et al. \(2020, p. 237\)](#) warn that money that was spent to support the Common Agricultural Policy should be reoriented to achieve “the environmental, sustainability, and rural development goals stated in the CAP’s new objectives, which would support the SDGs (Sustainable Development Goals), the European Green Deal, and green COVID-19 recovery”.

When investigating the effects of ESIFs investments connected with environmental policy and sustainable development, the majority of articles study the implementation of ESIFs or just one fund in a particular country. Most often, the analyses focus on specific fund investments within a country case study. [Sej-Kolasa \(2009\)](#) described possibilities for financing environmental protection projects through the European funds in Poland. [Hajdys \(2021\)](#) discusses the issue of financing environmental projects in Poland due to the shift in EU priorities towards the health crisis (COVID-19 related). She compares the allocation of funds for Poland in the financial perspectives of 2014–2020 and 2021–2027, concluding that the allocation from the EU cohesion policy has been reduced. However, she also highlights the amounts, calls and projects for financing the environment that represent an opportunity for investments. [Jeziarska-Thöle et al. \(2022\)](#) presented the development of the green economy concept and examined the correlation between the successful implementation of the green economy and the use of green payments under the Common Agricultural Policy in Polish rural areas. They confirm spatial variations in green economy development and the positive impact of the EU funds on the environment, but also highlight the differences across regions regarding the utilization of EU support.

[Borza et al. \(2016\)](#) researched environmental projects financing through European funds in Romania by comparing achievements and proposals. [Nigohosyan et al. \(2021\)](#) provide an analysis of the contribution of the ERDF through the operational programme “Innovation and Competitiveness” in Bulgaria to energy efficiency. The authors analyse the geographical and sectoral distributions, the relationship between grant size and energy savings (unit costs), and present estimates of correlation coefficients, linear regressions and the simple payback time for EU-financed projects. They found different results for big companies and SMEs, i.e., EU funds’ spending was more coherent and cost-effective in big companies than in SMEs. [Zikouli et al. \(2021\)](#) elaborate the contribution of ESIFs to sustainable development and forest parks in Greece. [Mugambi et al. \(2021\)](#) analysed the efficiency of ESIFs in Spain for renewable energy production and found that renewable energies were used with inconsistent efficiency among Spanish regions.

[Kyriazi and Miró \(2023\)](#) present the role of a new fund introduced in the 2021–2027 programming period, the Just Transition Fund. The fund supports the transition towards the Union’s 2030 energy and climate targets, as well as the goal of achieving a climate-neutral economy by 2050. EU member states whose territories are most negatively impacted by the green transition can access the grants (for more information see: [Official Journal of the European Union, 2021](#); [European Commission, 2024g](#)).

Additionally, in order to have a clear statistical basis for policy actions, measuring the contribution to the green transition and EU Green Deal goals has motivated various attempts to provide results by using diverse scoreboards and indicators related to these goals. Some of the indicators that track the contribution to the green transition and EU Green Deal goals at the EU and EU member state levels can be found in: [Charveriat and Holme \(2021\)](#); [European Commission \(2024i, 2024j\)](#); [European Union—Eurostat \(2024\)](#).

Green and digital transitions were identified as key drivers of EU growth in comprehensive reports on economic, social and territorial cohesion (European Commission, 2022; European Commission, 2024h). These reports discuss “a greener, low carbon Europe” and “green transition” as important parts of cohesion, where the authors highlight risks, the challenges of green and just transition, present the main trends at the national and regional level in terms of climate change and the environment. In the sections that deal with monitoring and evaluating the EU cohesion policy, these reports examine progress in EU funds investments towards a “Greener Europe”, where they use the data about ESIFs investments and achievements, common indicators that show the results of investments. They also comment on the positive results of the evaluations carried out in EU member states. These reports provide a more detailed analysis regarding the contribution of the ESIFs to green transition.

Based on the review presented above, in tracking the pillars and areas related to the green transition, the contribution of the EU cohesion policy and ESIFs play an essential role. Several questions arise: how to track the green transition in connection with the implementation of the EU cohesion policy, which indicators can be used to review investment progress (associated with different aspects of the green transition) and compare the results among EU member states (rather than focusing only on the EU level or on specific countries)? This paper explores these possibilities and provides a review of a potential background for future research regarding the impact of EU funds on the green transition.

3. Methodology

This paper uses desk research, synthesizes previous scientific studies, documents, implementation and evaluation reports, and analyses secondary data on financing under the ESIFs in EU member states. Previous scientific studies and reports that are connected with the European Green Deal goals and the (measuring of) contribution of the EU cohesion policy and ESIFs to the green transition were identified using relevant academic databases, official EU sources and other sources that publish studies and reports on the mentioned topics. The main aspects were synthesised in the thematic literature review. In order to provide a more detailed review of possible approaches in measuring the contribution of the ESIFs to the green transition and to perform a data analysis, evaluation reports and databases covering data about the ESIFs investments were used.

Evaluation of the EU cohesion policy includes evaluations by the European Commission and the Member States. The European Commission produces annual summary reports, strategic reports, provides guidance for evaluations and assists in evaluation procedures (European Commission, 2024e). An ex post evaluation of the funds for the 2014–2020 programming period is being conducted by the European Commission. Member States evaluate each programme to improve the quality of design and implementation, as well as to assess their effectiveness, efficiency and impact (European Commission, 2024m). These evaluations analyse the implementation and the results in a regional or national context. Evaluations carried out by EU member states are published in the library of the European Commission (2024f). Additionally, thematic evaluations can be used to examine the effects of investments in more detail. E.g., the “Ex post evaluation of major projects in environment financed by the European Regional Development Fund and the Cohesion Fund between 2000 and 2013” (European Commission, 2020) analyses the contributions of major projects in the environmental sector. These evaluations can be used to track the impact of ESIFs investments in EU member states, by specific thematic objectives. A descriptive analysis and synthesis of the latest available evaluation findings that are connected with the contribution of the ESIFs investments to the green transition is given in this paper. Key results are summarized based on the main thematic areas of this study.

In the Cohesion Open Data Platform ([European Commission, 2024b](#)), the latest data for the ESIFs are available for the 2014–2020 period, including the distribution of finances under different thematic objectives. This platform, published by the European Commission ([European Commission, 2024b](#)), enables the analysis of how funds are being used in EU regions and countries. The data on the achievements are available for the 2014–2020 programming period, so the data analysis focuses on this period. The study area in this paper includes EU member states, but the United Kingdom was included in the analysis because it was an EU member state during the analysed period. In the 2014–2020 programming period, the EU cohesion policy supported 11 broad priorities or thematic objectives. To track the investments connected with the green transition in this paper, the data about the investments under the following objectives were retrieved from the database: low-carbon economy, promoting climate change adaptation and risk prevention, environment protection and resource efficiency, and network infrastructure in transport and energy. The investments under the theme of network infrastructures in transport and energy are also included in our analysis as they foster sustainable transport and address bottlenecks in network infrastructure, including energy networks ([European Commission, 2024b](#)). The [European Commission \(2024j\)](#) presents an overview of the ESIFs' achievements by main policy and theme where “sustainable growth investments” cover the mentioned four themes. It is also highlighted that ESIFs' contributions to investments regarding a climate-neutral, clean and circular economy, environment and climate change adaptation help to reach the European Green Deal's goals ([European Commission, 2024j](#)).

The data retrieved from the Cohesion Open Data Platform ([European Commission, 2024b](#)) were visualized to present trends in implementation progress for investments by thematic areas connected with the green transition and to compare implementation progress between EU member states. Summarized data on achievements, based on common indicators and themes, along with the indicators of implementation progress relative to planned values were presented in the Appendix A and commented in the text. Descriptive and simple qualitative analyses were used to identify the patterns and interpret the main trends in implementation, as well as to provide a comparison across EU member states. The final discussion also includes the elaborations on the possible benefits in using these indicators as a part of a framework for measuring the contribution of the ESIFs to green transition, where the conclusions are based on studying different approaches in monitoring. Furthermore, the discussion summarizes and briefly describes some additional aspects that were not at the focus of data analysis but should be observed in measuring the contribution of EU cohesion policy and the ESIFs to green transition in the new 2021–2027 period.

4. Results and Discussion

In this section, a synthesis of the results regarding the current state and future efforts towards the green transition under the EU cohesion policy is provided. Special attention is dedicated to the progress in ESIFs' investments and the monitoring of key outputs, achievements that can be connected with the green transition.

The [European Commission \(2024m\)](#) indicates that, since January 2015, EU member states have published 2223 evaluations of 2014–2020 operational programmes co-financed by cohesion policy funds, confirming their commitment to evidence- and results-oriented approach to policymaking. As implementation progresses, evidence about the results is becoming more available, and the number of impact evaluations is increasing. In 2022, around 350 evaluations were published by EU member states. Furthermore, the [European Commission \(2024m\)](#) shows that according to the distribution of evaluations across thematic objectives, 239 evaluations of 2014–2020 cohesion policy operational programmes cover the “low-carbon economy” thematic objective, 70 evaluations address “climate

change”, 193 evaluations are connected with the thematic objective “environment” and 95 evaluations cover “network infrastructures” since 2015. Moreover, sustainable growth investments account for approximately 37% of the total ESI funding, constituting a significant contribution to the achievement of the European Green Deal’s objectives (European Commission, 2024j). It is therefore evident that thematic areas connected with the green transition are also important, specific components in the evaluations.

Results presented in the same reports regarding lessons on sustainable growth show that actions to improve energy efficiency in SMEs have proven to be effective. However, some evaluations suggest that overall effects are sometimes limited due to the small size of the companies and that investments in large companies might have occurred regardless of EU funding. Projects focusing on electricity generation and distribution, especially from renewable sources, and on reducing energy consumption across businesses as well as in public and private buildings, are yielding positive outcomes. Investment support has contributed to areas such as strengthening resilience to natural disasters and improving risk management systems (e.g., through new flood protection measures). Joint measures are recognized as important to provide resilience against the effects of climate change. Environmental protection measures (e.g., wastewater treatment and water supply measures) have contributed to achieving water policy objectives. Investments in railroads have helped reduce travel times and improve connections between cities. It is also important to estimate the impact at the end of the network projects’ implementation, which often takes longer to deliver results. It is recommended to consider other investments needed in multimodal nodes connecting rail and road infrastructure (European Commission, 2024m). These detailed evaluations confirm that they can be used as relevant sources in tracking the contribution of ESIFs investments to different aspects connected with the green transition. They provide specific indicators, describe the results of investments and confirm the benefits of investments, but also warn about the areas where future policy actions should be targeted to achieve better results. In this section, these results are supplemented with the latest available data for ESIFs investments, under different thematic objectives connected with the green transition, based on the European Commission (2024b).

Figure 1 presents the implementation progress (spent amount in % of the planned amount) by thematic areas connected with the green transition (according to the latest available data up to 31 December 2023).

By the end of 2023, 101% of the planned amounts (referring to the total budget) had been spent for “network infrastructures in transport and energy” (expenditure reported by the selected projects). Investments in low-carbon energy have accelerated, with 93% of the total planned amounts spent. Implementation rates for climate change adaptation and risk prevention and environment protection and resource efficiency stand at 91%.

Figure 2 presents the implementation by country for the low-carbon economy (according to the latest available data, up to 31 December 2023). Comments that follow are focused on the spent amount in % of the planned amount, because this indicator helps track progress towards the initial intended objectives. Figures also present the decided amount in % of the planned amount. Decided amounts represent financial resources allocated to selected projects and in monitoring the results it is also possible to analyse the spent amount as a % of the decided amount.

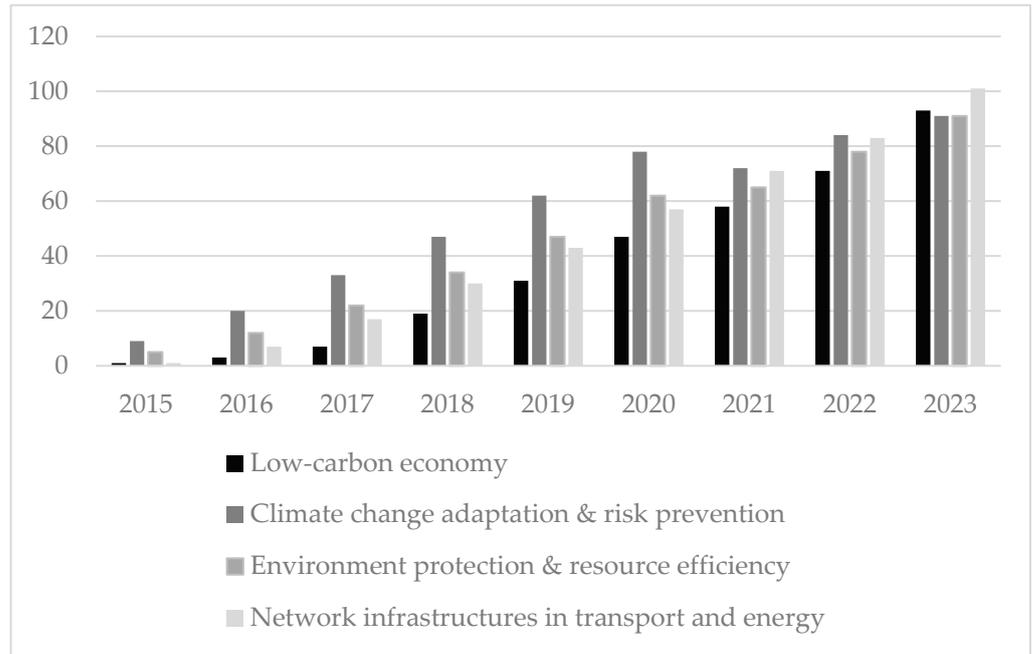


Figure 1. ESIFs 2014–2020: implementation progress (total cost) by thematic areas connected with the green transition, 2015–2023. Source: authors based on [European Commission \(2024b\)](#).

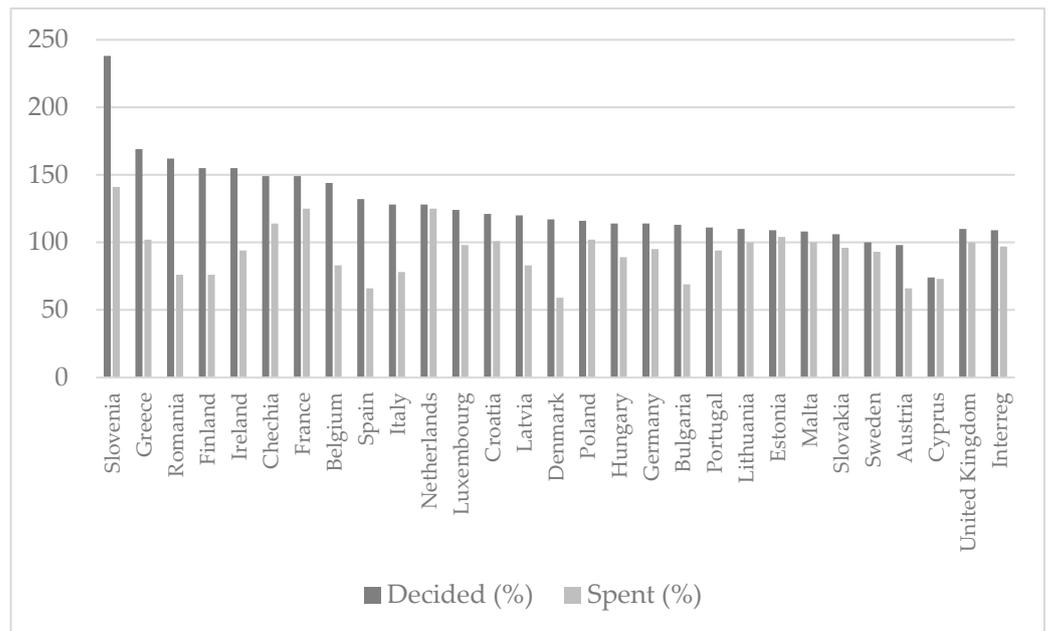


Figure 2. Implementation by country for low-carbon economy, total cost of selection and spending as % of planned amounts (multi-thematic allocations are excluded). Source: authors based on [European Commission \(2024b\)](#).

According to Figure 2, Slovenia, the Netherlands and France have the highest spending shares (expenditure reported by the selected projects as a percentage of planned) for projects connected with the low-carbon economy. Denmark, Spain and Austria have the lowest shares. Many programmes award support that exceeds the total planned cost to mitigate the risks of some decided, selected projects failing to materialise, or risks of irregularities during implementation that result in the withdrawal of support.

Figure 3, which refers to climate change adaptation and risk prevention, shows that the highest spending shares are in the United Kingdom (as mentioned before, it was included because it was an EU member state during the analysed period), Finland, Cyprus and

Hungary. Conversely, Malta, Denmark and Poland have the lowest shares in comparison with other EU member states.

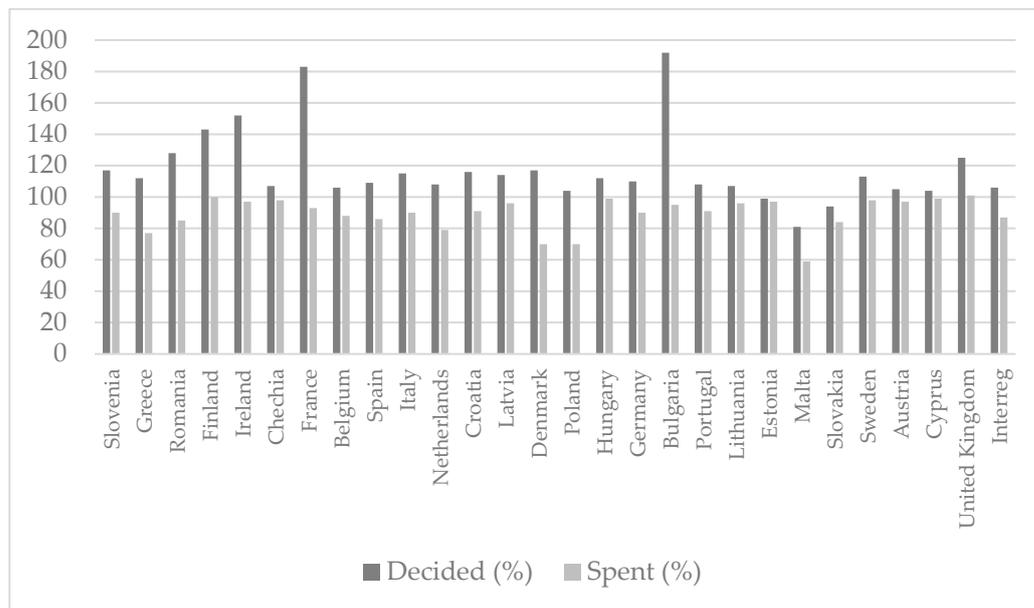


Figure 3. Implementation by country for climate change adaptation and risk prevention, total cost of selection and spending as % of planned amounts (multi-thematic allocations are excluded). Source: authors based on European Commission (2024b).

Croatia, Estonia, Hungary and Luxembourg have the highest spending shares of the funds on projects for environmental protection and resource efficiency, while the lowest shares belong to Spain, the Netherlands and Denmark (as seen in Figure 4).

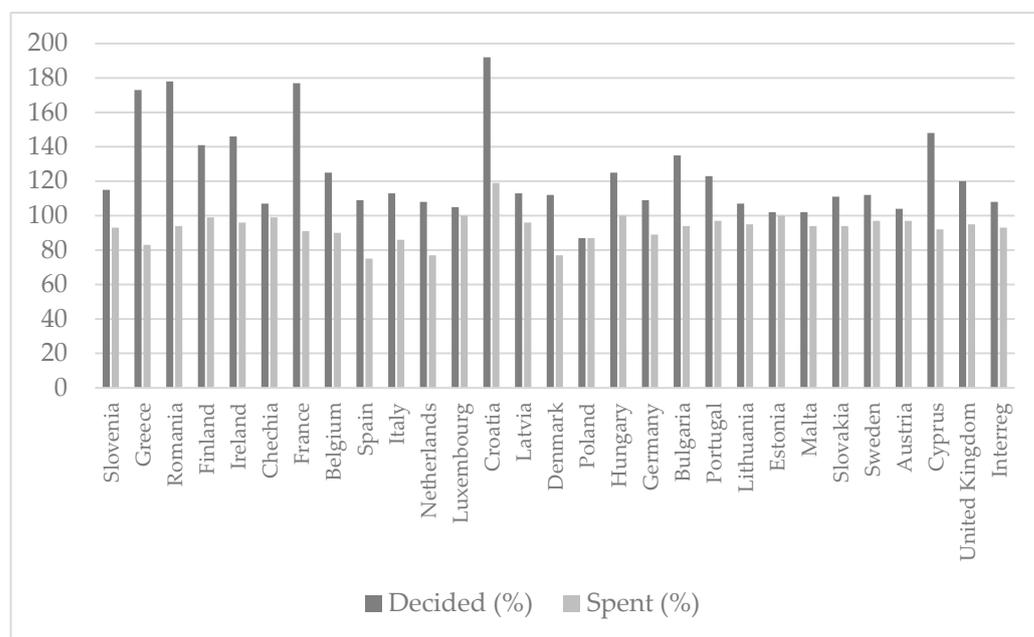


Figure 4. Implementation by country for environment protection and resource efficiency, total cost of selection and spending as % of planned amounts (multi-thematic allocations are excluded). Source: authors based on European Commission (2024b).

The United Kingdom, Hungary and Malta have the highest spending shares for projects related to network infrastructure in transport and energy, while Spain, Portugal and France have the lowest (Figure 5).

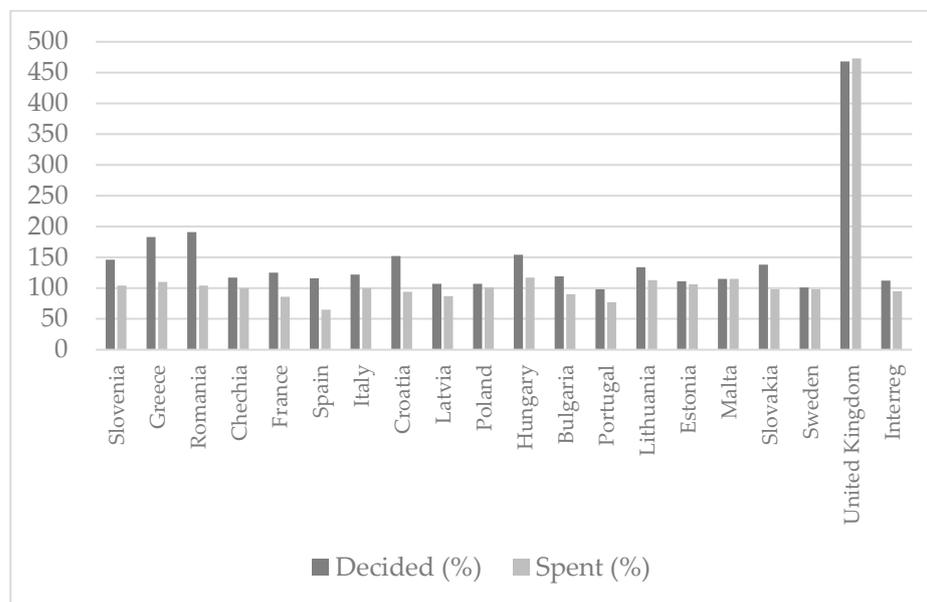


Figure 5. Implementation by country for network infrastructure in transport and energy, total cost of selection and spending as % of planned amounts (multi-thematic allocations are excluded). Source: authors based on [European Commission \(2024b\)](#).

Even though less developed EU countries have problems with structural transformations challenges, lack of capacities for the green transition, less developed infrastructure and various problems of socio-economic development, they can use the ESIFs as valuable instruments to perform changes in different areas, including the green transition domains. The results show that in some cases less developed EU member states nevertheless have a higher spending share as % of their planned investments in the observed thematic areas in comparison with the developed EU member states. This can imply that EU cohesion policy supports transformations in the less developed countries/regions and confirm their commitment to use financing opportunities of the EU funds, but also that their needs for additional financing are higher. The efforts towards the green transition can contribute to minimizing issues related to relying on carbon-intensive industries, climate change adaptation, pollution, environmental degradation etc., but this should be supplemented with integrated reforms and structural changes also in other areas, including governance quality and institutional capacities, which are facing significant issues in these countries. This must be anticipated on time to reduce unfavourable effects, e.g., regarding the impact on economic growth and convergence, loss of jobs in some sectors, rising energy costs, problems with capacities, other economic losses and the risks of rising inequalities during the process of green transition. The green transition should be planned and implemented bearing in mind that these countries will need more time and additional efforts to adapt to changes. Gradual transition timelines and coordinated actions are necessary. This is also in line with previous research that confirms the need for coordinating actions of EU, national and regional policies and that the goals of the European Green Deal which guides the green transition are not goals per se. They incorporate a wide range of policies, instruments that are focused on implementing changes across different sectors and must be tailored to the characteristics of individual countries that have different perspectives towards the green transition. Experiences and practices, knowledge and technology transfers from the more

developed countries can be also useful for the less developed countries, where cooperation programmes through EU cohesion policy can help implement solutions. Regarding developed countries, we can highlight here that in the process of green transition, which also includes technological innovations and transformations, these countries must reduce the risks for vulnerable sectors, large industries, jobs and places. They have to strengthen their resilience and competitiveness through an approach that will mitigate the costs of the green transition, other negative effects and achieve the benefits of the green transition, use opportunities for labour market transformations etc., where ESIFs can help in balancing these confrontations.

The tangible achievements confirming the benefits of the ESIFs' investments are presented in Table A1 in Appendix A (at the end of the paper). This table shows the implementation progress based on various common indicators used under the different ESIFs, categorized by themes. The results of investments can be tracked through these indicators that monitor and indicate the contribution of ESIFs to the low-carbon economy, climate change adaptation and risk prevention, environmental protection and resource efficiency, and support for network infrastructures in transport and energy, which are areas connected with the green transition, as described in this paper. These common indicators present the concrete outputs from expenditures and are related to the targets set, which is the advantage of using them in tracking the contribution of the ESIFs. It is obvious that these indicators under the specific themes do not rely on only one or a few indicators; therefore, common indicators provide a more comprehensive and more specific overview of the achievements. Even though the presented indicators confirm the significant achievements at the end of the observed period across all themes (the previously commented results of evaluation reports confirm similarly), some of them are reporting lower values if we look at the implementation progress as a % of the planned. It is possible that the indicators currently reporting lower values will show higher results by the end of the implementation (especially those connected with infrastructure), but these and other areas with lower results must be observed with caution when considering the new targets. Further investigation across countries is needed to understand why the implementation is lower (in future studies).

ESIFs also contribute to other thematic objectives, such as smart growth. Fostering innovation through smart-specialization strategies is essential for addressing different priorities, including the European Green Deal. There are projects focused on clean technology, green technology, sustainable solutions, green and circular business development, etc. (European Commission, 2024j).

The European Commission (European Commission, 2024j) reports that the EU set a climate-spending target of at least 20% for the 2014–2020 period, and 26% of the ESIFs were allocated to climate action objectives. Additional allocations are provided under REACT-EU. More details on climate tracking results can be found in Walsh (2021) and the European Commission (2024a).

By investigating various scientific research, expert studies, databases on ESIFs' investments and achievements, common indicators and other databases connected with scoreboards and indicators that analyse the contribution to the green transition and the European Green Deal, the complexity of the possible indicators that can be used in tracking the green transition is confirmed. Regarding the contribution of the EU cohesion policy to the "greener Europe" goal, the Cohesion Open Data Platform can be used as a relevant database. The benefits of this platform are also recognized in the evaluations which are important for promoting transparency and providing a basis for policymaking. Progress in financial implementation has been confirmed, along with progress based on common indi-

cators by the end of 2023. Additional efforts are required in countries with high demands but low absorption to achieve the defined targets for the green transition.

Another aspect that was not the main focus of this paper but should be covered in order to give a more comprehensive discussion about the measuring the contribution of the EU cohesion policy to green transition is the fact that some regions (which are also key actors in EU cohesion policy implementation) may lag behind in comparison with other regions (even within the same country). The [European Commission \(2024h\)](#), in its “Ninth report on economic, social and territorial cohesion”, highlights that the effects of climate change in the EU exacerbate regional disparities, especially in coastal, Mediterranean, and south-eastern regions, which risk losing over 1% of GDP annually. Regions with heavy industry have the highest greenhouse gas emissions per capita and decarbonisation efforts should be seen across all sectors. Opportunities exist for rural, less developed regions that have the potential for wind and solar energy, which can enhance their innovation and competitiveness. There is a need for a skilled workforce capable of developing and implementing the necessary changes. Shifts to green employment still favour more developed regions. The report further describes other concerns connected with the transition. The risks for regional disparities as a result of the twin (green and digital) transition are also discussed in [Maucorps et al. \(2023\)](#).

When considering the green transition, it is also important to include observations about the resources necessary for this transition (e.g., investigations about raw materials for energy transition, as presented in [Kovalenko, 2024](#)). These aspects should be included in future research and in measuring the constraints of the green transition.

In the end, if we take a brief look at the current 2021–2027 programming period, the new governance processes in the EU set the guidelines on how to accelerate and achieve the green transition, and emphasize the need for clear monitoring and reporting. As mentioned before, one of the clearly defined priority objectives for the 2021–2027 programming period is “greener Europe”, while the 2021–2027 programs provide additional resources to support sustainable recovery and transition thorough initiatives such as NextGenerationEU, the Recovery and Resilience Facility, REACT-EU, financing for the Just Transition Fund and extra funds for resilience.

In 2022, the European Commission introduced the REPowerEU Plan as an official response to the energy challenges raised by the Russian invasion of Ukraine ([European Commission, 2024k](#)). Over the past 2 years, the contribution to the REPowerEU Plan’s targets has been confirmed (e.g., it has helped the EU save energy, diversify its supplies, produce clean energy and smartly combine investments and reforms) ([European Commission, 2024d](#)). The second tranche of the Recovery Assistance for Cohesion and the Territories of Europe (REACT-EU), amounting to EUR 11 billion, supplemented the ESIFs in 2022. In December 2022, the Supporting Affordable Energy (SAFE) instrument was also adopted, enabling Cohesion Policy funds to assist vulnerable households, workers, and SMEs facing rising energy costs ([European Commission, 2024j](#)). The EU cohesion policy reaffirms its important role during the crisis and in achieving the main policy goals of the EU, such as the orientation to greener Europe. These new funds that are used in the 2021–2027 period and contribute to green transition can be another additional aspect that should be investigated in the 2021–2027 programming period.

5. Conclusions and Implications

Priorities of the EU cohesion policy evolve over time and change according to current needs. The paper highlights the importance of tracking the green transition and the progress made in using the ESIFs to finance areas related to this transition. The challenges in the measurement stem from the complexity of the areas involved, data availability and the

potential methodological tools that can be used in tracking, monitoring and evaluating the effects. Although the EU cohesion policy has a crucial role in supporting the green transition, the measurement of its contribution, capturing and assessing its impact on the green transition across EU member states was less investigated in previous studies.

This paper tries to give a systematic overview of the possible approaches in measuring, relying on previous studies, evaluation reports and the data that have been monitored during the implementation of the EU cohesion policy. Lack of comprehensive metrics that account for all the areas of the green transition has been confirmed, but there are evaluation reports and common indicators connected with the ESIFs investments by thematic priorities that can be useful in monitoring and evaluating the effects of the EU cohesion policy on the green transition. The green transition actions take years to yield effects, and there are also differences between EU member states, which is why continuous monitoring is important to direct future initiatives in due time. This should be based on harmonized measurement framework.

Differences between EU member states indicate that some should accelerate their spending rates and use new funding opportunities to achieve better results in sustainable and green development. This approach is reflected in the creation of the EU policy framework, including the EU cohesion policy, which emphasises the green transition through guidelines, new regulations and the allocation of resources through EU funds. EU funds are significantly directed towards less developed EU countries/regions and in the 2021–2027 programming periods there are new instruments that, for example, support the regions most affected by the transition. Less developed EU member states also have to make additional efforts to balance the priorities that are directed towards the green transition with the priorities that are targeted towards solving their specific socio-economic problems. ESIFs present an opportunity to implement structural transformations in various areas, and complementary actions that include different targets should be considered in the development planning processes. ESIFs can also support the adoption of new, innovative solutions for the green and just transition in these countries, and help achieve economic diversification, but capacities and institutional structures should be strengthened to obtain positive effects. Costs of the green transition should not be underestimated neither in developed nor in less developed countries. Support for workers and firms, measures to ensure energy affordability, reducing the risks for vulnerable sectors and regions, strengthening capacities for transition, adaptation to new regulations etc. must be planned on time to reduce unfavourable effects. Environmental goals must be connected with economic and social goals. More developed countries also face challenges related to competitiveness (especially in comparison with non-EU countries) during the process of green transition. EU funds can help reduce the risks and costs of the transition, connecting the interests of sustainable, green, and inclusive growth. This is not only from a financial perspective but also through the opportunity to create projects that encompass these different yet interconnected goals.

To plan and achieve the positive effects of EU funds for the green transition, monitoring and evaluation of the ESIFs investments is crucial for effective and transparent policymaking. This study presents a preliminary overview of the efforts to measure the green transition within the framework of the EU cohesion policy, by extending the approaches and scopes of the previous studies. It gives an overview of the previous studies that are relevant for tracking the green transition within the framework of the EU cohesion policy, including broader policy frameworks, and goes beyond analyses that focus on a specific country, includes the last available data across EU member states about the ESIFs investments under different thematic areas connected with the green transition and presents progress indicators that can be used in tracking. In the final discussion, the au-

thors also briefly highlight the aspects that were not the main focus of the analysis but should be reconsidered in monitoring the contribution of the EU cohesion policy to the green transition.

Given that green economy is a very comprehensive term, more reliable results could be achieved by focusing on one thematic area with an analysis of the more detailed intervention fields. To obtain more precise results on the impacts of EU funds, it would also be necessary to apply a more complex methodology, where data availability plays an important role and also represents a constraint. In the future studies, based on data availability, it would be interesting to estimate the relationship between investments in specific areas, such as low-carbon economy, climate change adaptation and risk prevention, environment protection and resource efficiency, network infrastructure in transport and energy and the progress towards target values in the EU (member states). This analysis can also consider each member state individually, including the regional level, where results can significantly differ. As described before, in the 2021–2027 programming period, new instruments have been introduced to support EU member states and regions in their green transition. Therefore, it would be valuable to focus the future investigations on the success of these new opportunities.

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Appendix A

Table A1. Achievements—common indicators by themes (up to 14 December 2023).

Achievements—Common Indicators by Themes	Number and Implementation Progress (Implemented as a % of Planned)
Low-carbon economy indicators	
All firms receiving support	46,640 enterprises (95.1%)
Firms receiving grants	10,896 enterprises (80.4%)
Firms receiving financial instrument support (non-grants)	1527 enterprises (82.4%)
Firms receiving non-financial support (advice)	12,898 enterprises (212.5%)
Startups supported	645 enterprises (86.1%)
Private investment matching public support to enterprises (grants)	1,774,376,732 EUR (87.5%)
Private investment matching public support to enterprises (non-grants)	109,341,387 EUR (95.3%)
Direct employment increase in supported enterprises	2668 full time equivalents (32.7%)
Urban transport: total length of new or improved tram and metro lines	149 km (38.6%)
Land rehabilitation: total surface area of rehabilitated land	40 hectares (19.05%)
Research, Innovation: number of new researchers in supported entities	138 full time equivalents (170.6%)
Research, Innovation: number of enterprises cooperating with research institutions	2741 enterprises (282.9%)

Table A1. Cont.

Achievements—Common Indicators by Themes	Number and Implementation Progress (Implemented as a % of Planned)
Low-carbon economy indicators	
Research, Innovation: private investment matching public support in innovation or R&D projects	82,505,148 EUR (55.5%)
Research, Innovation: number of enterprises supported to introduce new to the market products	1126 enterprises (185.8%)
Research, Innovation: number of enterprises supported to introduce new to the firm products	1656 enterprises (180.6%)
Renewables: additional capacity of renewable energy production	5264 MW (71.8%)
Energy efficiency: number of households with improved energy consumption classification	549,678 households (93.3%)
Energy efficiency: decrease of annual primary energy consumption of public buildings	3,496,511,065 kWh/year (55.4%)
Energy efficiency: number of additional energy users connected to smart grids	643,448 users (17%)
GHG reduction: estimated annual decrease of GHG	9,442,524 tonnes of CO ₂ eq (49.2%)
Urban: population living in areas with integrated urban development strategies	9,027,287 persons (68.4%)
Urban: open space created or rehabilitated in urban areas	229,196 square metres (102.1%)
Productive investment: number of enterprises participating in cross-border, transnational or interregional research projects	6075 enterprises (458.8%)
Productive investment: number of research institutions participating in cross-border, transnational or interregional research projects	538 organisations (274.5%)
Total investment (private and public) in renewable energy production	1,216,340,293 EUR (46.08%)
Agricultural land under supported management contracts to reduce GHG and/or ammonia emissions	6,199,462 ha (114.8%)
Total investment (private and public) for energy efficiency in agriculture and food processing	1,695,280,893 EUR (46.94%)
Livestock unit concerned by investments in specific management to reduce GHG and/or ammonia emissions	2,520,925 livestock units (109.2%)
GHG and ammonia emissions of total livestock unit concerned by investments in specific management to reduce GHG and/or ammonia emissions	5.3% (planned 4.8%)
Number of permanent cessations in the fishery sector	1622 number of operations (130.3%)
Climate change adaptation and risk prevention	
Risk prevention and management: population benefiting from flood protection measures	29,206,582 persons (85.4%)
Risk prevention and management: population benefiting from forest fire protection measures	23,811,623 persons (64.2%)
Land rehabilitation: total surface area of rehabilitated land	137 hectares (88.4%)
Nature and biodiversity: surface area of habitats supported to attain a better conservation status	12 hectares (52.2%)
Farm holdings participating to supported income stabilisation tool	638,151 farm holdings (88.7%)

Table A1. Cont.

Achievements—Common Indicators by Themes	Number and Implementation Progress (Implemented as a % of Planned)
Environment protection & resource efficiency	
All firms receiving support	13,681 enterprises (159.3%)
Firms receiving grants	262 enterprises (85.1%)
Firms receiving non-financial support (advice)	7658 enterprises (132.8%)
Private investment matching public support to enterprises (grants)	11,223,387 EUR (106.9%)
Private investment matching public support to enterprises (non-grants)	10,451,405 EUR (65.73%)
Increase in expected number of visits to supported sites (cultural, natural heritage and attractions)	42,117,626 visits/year (73%)
Solid waste: additional waste recycling capacity	3,383,434 tonnes/year (59.8%)
Water supply: additional population served by improved water supply	8,318,597 persons (58.3%)
Wastewater treatment: additional population served by improved wastewater treatment	9,151,696 population equivalent (44.8%)
Risk prevention and management: population benefiting from flood protection measures	43,770 persons (328.4%)
Land rehabilitation: total surface area of rehabilitated land	3026 hectares (56.1%)
Nature and biodiversity: surface area of habitats supported to attain a better conservation status	11,175,059 hectares (111.4%)
GHG reduction: estimated annual decrease of GHG	79,124 tonnes of CO ₂ eq (17.8%)
Urban: population living in areas with integrated urban development strategies	8,013,114 persons (82%)
Urban: open space created or rehabilitated in urban areas	15,806,412 square metres (68.3%)
Urban: public or commercial buildings built or renovated in urban areas	736,184 square metres (75.3%)
Urban: rehabilitated housing in urban areas	315 housing units (32.2%)
Productive investment: number of enterprises participating in cross-border, transnational or interregional research projects	8078 enterprises (820.9%)
Productive investment: number of research institutions participating in cross-border, transnational or interregional research projects	1994 organisations (574.6%)
Area of organic farming supported	67,500,238 ha (495.6%)
Forest area under management contracts supporting biodiversity	2,336,955 ha (59.4%)
Of total forest area under management contracts supporting biodiversity	1.9% (planned 3.3%)
Agricultural land under management contracts supporting biodiversity and/or landscapes	35,728,391 ha (103.3%)
Of total agricultural land under management contracts supporting biodiversity and/or landscapes	20.3% (planned 19.7%)
Recirculation system—aquaculture change in the volume of production recirculation system	4794 tonnes (26%)
Number of operations on implementing the Union's control, inspections and enforcement system	1093 number of operations (170.2%)
Number of operations on supporting the collection, management and use of data	190 number of operations (283.6%)
Change in the volume of production organic aquaculture	6578 tonnes (65.1%)
Aquaculture farms providing environmental services	1417 aquaculture farms (117.8%)
Number of serious infringements detected	13,912 infringements (185%)
Other protected spatial areas change in the coverage of other spatial protection measures under Art. 13.4 of the Directive 2008/56/EC	24,138 km ² (5.5%)
Number of operations on Integrated maritime surveillance	26 number of operations (74.3%)
Change in the coverage of Natura 2000 areas designated under the Birds and Habitats directives	24,919 km ² (43.5%)

Table A1. Cont.

Achievements—Common Indicators by Themes	Number and Implementation Progress (Implemented as a % of Planned)
Network infrastructure in transport and energy	
All firms receiving support	2771 enterprises (191.1%)
Railway: total length of new railway line, of which: TEN-T	146 km (34.6%)
Railway: total length of reconstructed or upgraded railway line	2164 km (48.9%)
Railway: total length of reconstructed or upgraded railway line, of which: TEN-T	1349 km (47.9%)
Roads: total length of newly built roads	3570 km (98.3%)
Roads: total length of newly built roads, of which: TEN-T	2492 km (99.4%)
Roads: total length of reconstructed or upgraded roads	8804 km (77%)
Roads: total length of reconstructed or upgraded roads, of which: TEN-T	818 km (91.1%)
Urban transport: total length of new or improved tram and metro lines	79 km (84.8%)
Inland waterways: total length of improved or created inland waterway	1215 km (110.3%)
GHG reduction: estimated annual decrease of GHG	12,350 tonnes of CO ₂ eq (107.4%)

Source: authors based on [European Commission \(2024b\)](#).

Note

- ¹ The Recovery and Resilience Facility is an instrument introduced as part of the NextGenerationEU, the EU's plan to provide financial aid to member states during the pandemic and post-pandemic period (more in: [European Commission \(2024p\)](#)).

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